An Edge Computing Technique for Real-Time Health Monitoring Based on Deep Transfer Learning

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Abstract

In the event of a pandemic or epidemic, the healthcare system is put under extreme strain. Certain pandemic infections, like COVID-19, are easily transmitted from infected person to healthy person. Consequently, it is important to help noncritical infected patients who are isolated by providing them with health treatments in the comfort of their own homes. This method is also quite helpful for keeping tabs on how at-home seniors are doing when it comes to their health. One such area of home health care that does not intrude on patients' or seniors' privacy is home health monitoring, which involves constant observation of the patient or elder using visual sensors. In this work, we present a home health monitoring system that uses edge computing powered by transfer learning. In particular, a minimal quantity of ground-labeled data and a fine-tuning strategy may be used to use edge devices to train a model using a previously trained convolutional neural network. This means that inexpensive on-site processing of visual data acquired by an RGB, depth, or temperature sensor may be feasible. This eliminates the need to transmit raw data from these sensors outside the house. This means that concerns about being watched or having insufficient bandwidth will be moot. The aforementioned uses for real-time computing should also be feasible on a budget. Deep Learning, Computing, Learning Techniques, Visual Sensors, and the COVID-19 Pandemic are all discussed as potential application areas for AI in health monitoring.

1. Introduction

There are just around 2 million beds available in India's hospitals of all types. accessible now for the world's 1.35 billion-person population [1]; the ratio of beds to persons is quite low (just 1.4). In addition, this is not near as good as in the West [2]. Furthermore, those nations that rank similarly high on that list may likewise be unable maintain equilibrium in the face of a pandemic's difficulties. Therefore, The current state of home health care is inadequate to meet the demands of a contagion-like virus outbreak, such the COV-19 virus. In addition, since the The number of elderly individuals raising children [3] is on the rise. Moreover, home health care is an effective health strategy for people in their golden years who still reside at home. Since Machine Learning (AI) is helping people in various ways [4, 5, 6]. Therefore, Home healthcare services might benefit greatly from the use of AI [7]. [8]. Telematics-based care for the elderly (in a nutshell, we are One such non-invasive technique is "Home Health Monitoring," which an economically significant niche for these services may track things like movement, sleep, and even breath surveillance, detecting falls,

interpreting expressions, Identifying spoken language, tracking hand hygiene, etc. [9]. The combination of machine learning (DL) and computational effective in [10], [11], and [12] research on CV. Nevertheless, DL necessitated GPU-enabled hardware, notably for CV jobs. devices capable of running software written for a computer [13], that may not be household. One possible solution to this problem is to make use of transmission of data is required for the cloud computing[14] method. to a server in the cloud for handling away from home. Yet, in this situation, you must consider issues of confidentiality, safety, and limited bandwidth. Complex problems and real-time computation could be incompatible [15]. These penalties encourage the adoption of cutting-edge technological To the Edge Computing [16]. Computing with EC is possible. information gathered by a home health monitor when the subject is at home.

Edge devices (ED) have many advantages, but they also present certain difficulties. tiny in size and processing power [17]. In Furthermore, the DL-based approach often need a sizable data, another formidable obstacle for the healthcare industry [18].The method we suggest in this paper is based on deep transfer learning, which A Home Health Monitoring Method Using Edge Computing (TL-ECHM). A transfer learning strategy is considered, in which a using a model of a convex neural network (CNN) which has been pre-trained using the available data. Fine-tuning ED requires just trace quantities of ground labeled. dataset. The amount of time required for processing would be drastically cut down. emergency room settings that need local visual computing resources. As a result, it ought to mitigate these issues somewhat. The diagram depicts a scenario in which a medical care facility, cloud services, emergency department, and the Internet of Things gadget (sensor) are all interconnected parts of a bigger system. Below are the article's main arguments.

Reducing hospital readmissions and improving quality of life with in-home health monitoring for children and the elderly is the focus of our study article, which we discuss here.

the current health situation is a catastrophe.

- We provide a technique (TL-EC-HM) that combines DTL and
- The use of EC in health-tracking at home.
- We investigate the proposed TL-EC-HM, a privacy-protecting
- to do graphical processing locally.
- We suggest several avenues for further study.

2. Related Work

"Data Mining for Predictions in Cardiovascular Disease,"

Although a great deal of data is generated at healthcare institutions (hospitals, clinics, etc.), little of it is put to good use. Data abound in the healthcare system, but understanding is lacking. There is a dearth of efficient analytic tools for mining health care data for insights. Using data mining methods might help fix the problem. This opens the door for several data mining strategies to be used. Purpose of the Report provide specifics on how current research into cardiovascular disease prognosis is using data mining tools for knowledge abstraction. In this study, we apply several data mining techniques to medical datasets and assess the results using various algorithms.

"Data Mining for Predicting Cardiovascular Disease"

However, not all of the Healthcare data collected is mined, which is essential for finding obscure patterns and developing sound decisions in the healthcare business. For the purpose of predicting cardiac issues, we suggest a genetic algorithm that makes use of the back propagation method. In this study, we look at heart disease prediction algorithms that take a wide variety of factors into account. The chance of a patient developing heart disease is calculated using 13 different variables, including medical words like gender, blood pressure, and cholesterol.

"Machine Learning Algorithms for Predicting Cardiovascular Disease"

The health care industry generates massive amounts of data, which need the adoption of specific methods for analysis. Data mining is a popular method that serves several purposes. In terms of mortality rates, heart disease is far and away the worst. This Method foresees the Emergence of Heart Disease. This system's outputs give percentage-based heart disease risk assessments. Medical indices are used to categorize the datasets. Using a classification method derived from data mining, this system ranks those criteria. Two primary Of the many machine learning algorithms out there, Decision Tree and Naive Bayes are two of the most popular. are applied to the datasets in Python, with the latter proving to be the more accurate in predicting cardiac issues.

“Heart Disease Classification Algorithm Prediction"

Worldwide, heart disease is responsible for the greatest number of deaths. Doctors and nurses have a tough time anticipate a heart attack is a hard undertaking requiring training and practice before it can be done successfully. Today's health care industry conceals data that might be crucial for future decision-making. In this study, data mining techniques including J48, Naive Bayes, Logistic regression, CART, and Naive Bayes are used to forecast cardiac events. The study found that the accuracy of the predictions was 99. The health industry may use data mining to learn from the data and make predictions.

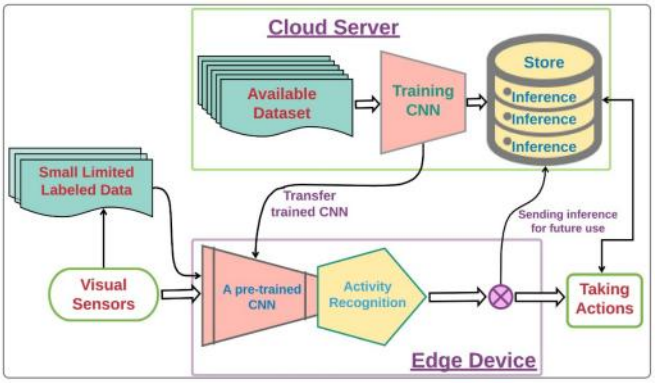
"Internet of Things-Based Patient Health Monitoring"

Research and development in the field of wireless sensing nodes has blossomed in recent years, making significant contributions to contemporary healthcare. The perilous state in which patients find themselves due to the specific cause of cardiac issues and attack when they do not get enough medical care at the proper time. This is meant to be used by family members and medical staff to keep tabs on the health of the elderly. To avoid these tragedies, we offer a new idea based on Health Status Monitoring that would utilize sensors and the internet to notify loved ones if there was a problem. Thermometer and pulse rate sensors are used to track the patient's condition. Connecting the two sensors to the Arduino-uno. A micro-controller linked to an LCD display and a wireless network keeps tabs on the patient's health (wireless sensing node). The Internet of Things can send a warning if a patient's heart rate or temperature suddenly fluctuates. The technology also provides timestamped, real-time data, like a patient's temperatures and heart rate, through the Internet. Hence, an IoT-based client health monitoring system makes use of the internet to effectively monitor patient health, enabling the user to maintain tabs on loved ones even while they are at work.

3. Methodology

We propose a technique for analyzing and forecasting healthcare data that relies on a trifecta of cutting-edge technologies: the Internet of Everything (IoT), computing, and the deep

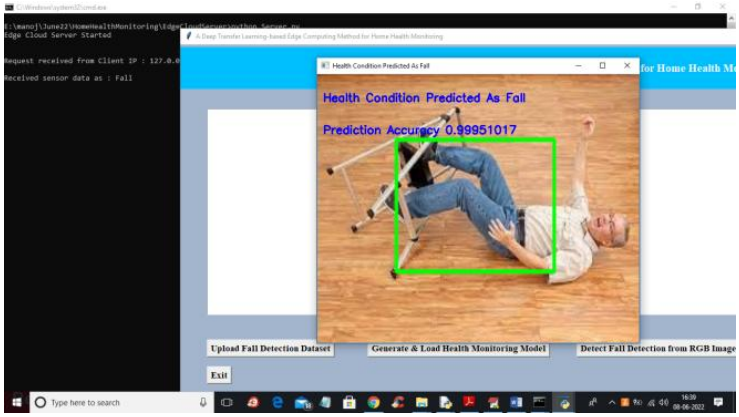
learning model of CNN. Fast data flow between patients and physicians is enabled by the edge devices' connections to IoT sensor nodes. Edge servers' primary function is to maximize throughput and reaction times actual time. edge computing's layered IoT architecture. Sensors, peripheral gateways, a fog layer with a LoRa connection, and a cloud layer all work together to enable connectivity in this design. Vital indicators, such as sugar levels, pulse rate, and blood pressure, may be tracked using Internet of Things nodes. Access points transmit the acquired data to the edge gateways. In the realm of real-time communication, the fog layer facilitates dynamic allocation. Smart control systems for Internet of Things applications & gadgets [[16], [17], [18]] are now feasible thanks to today's lightning-fast processors, vast storage spaces for data, and broad network infrastructure. The edge layer will outperform the fog layer in terms of performance because to its low latency, excellent quality computing and its use of dynamic both logical and physical resource distribution on the server.



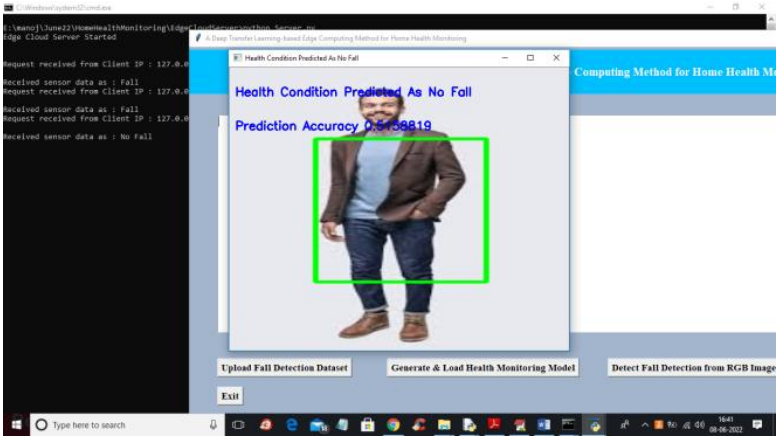
A graphical look of proposed pipeline of TL-EC-HM

4. Result and Discussion

Dataset open will then load the supplied Accident Detection Dataset. it may be used to develop and load models for use in health monitoring. Utilize a jpeg image's rgbcolors to determine whether a person has fallen.



As with the previous image, artificial intelligence has predicted that the above image depicts a FALL; it is now being put to the test against further images.



The child's status is indicated up top, and it now reads "NO FALL."

5. Conclusion

Home health monitoring would be very helpful in mitigating the effects of a pandemic and in providing cost-effective care for the elderly. A computer system is suggested in this article. computer processing in the periphery, based developing a machine-vision system that makes use of deep transfer learning. The approach is devoid of the constant transmission of raw visual data acquired by a visual sensor since it processes the data internally (s).Because this is the case, concerns about latency, data security, and privacy are moot.

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